

**Morphologies of laser-induced damage in hafnia-silica  
multilayer mirror and polarizer coatings.**

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Hafnia-silica multilayers mirrors and polarizers were deposited by e-beam evaporation onto BK7 glass substrates. The mirrors and polarizers were coated for operation at a wavelength of 1.053  $\mu\text{m}$  at 45° and at Brewster's angle (56°), respectively. They were tested at their use angle of incidence with a single 3-ns laser pulse. The morphology of the laser-induced damage was characterized by optical and scanning electron microscopy. Four distinct damage morphologies were found: pits, flat bottom pits, scalds, and delaminates. The pits and flat bottom pits (< 30  $\mu\text{m}$  in diameter) were formed at the lower fluence (below 10 J/cm<sup>2</sup>). The pits seemed to result from ejection of nodular defects causing local enhancement of the electric field. Scalds and delaminates could be observed at higher fluences (above 12 J/cm<sup>2</sup>) and seemed to result from the formation of plasmas on the surface. These damage types often originated at pits. The effects of the damage on the characteristics of the beam (reflectivity and phase modulations) were measured.

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